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## TIMEX SINCLAIR USERS GROUP MILE HIGH CHAPTER

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C/O FRANK HOLLAND, 1423 S. PEARL ST., DENVER CO 80210, 733-8103

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OCT. 1987 \*\* Penumbral eclipse of the moon on the 6th. 9:53 EDT  
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TSUG meetings are on the 4th Thursday of every month.  
This months meeting is on the 22th, at 7:30 PM, at my home.  
\*\* PAY ATTENTION TO THIS \*\*  
The NOV. meeting will be on the 3rd Thursday (the 19th) because  
of Thanksgiving. The DEC. meeting is cancelled altogether  
because of the holidays.  
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MILE HI TSUG maintains a sub-board on THE KING'S MARKET BBS.  
1-303-665-6091, 8-1-NONE. Accessible thru PC-PURSUIT.  
MENU SELECTIONS TO GET TO THE SUB-BOARD ARE:

- (1) CONTENTS
- (2) INTERESTS & USER GROUPS
- (3) TIMEX-SINCLAIR

General messages for club members are addressed to "ALL".

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Those of you with modems who have been logging on to THE  
KINGS MARKET recently may have been following the slightly  
irregular installments of THE MISADVENTURES OF ROGER HUNTER AND  
HIS ELECTRIC CONVERSION.

For those of you who have not been logging on, Roger has  
been installing his QL in an IBM/XT case and adding a new  
keyboard.

Roger has successfully completed the project and prepared a  
complete write-up for publication here. While it doesn't have  
the same sense of drama (complete with cliff-hangers), it does  
provide all of the necessary information for those who would  
like to perform similiar surgery on their QL's.

NOTICE: Neither Roger Hunter nor the MILE-HI TSUG accept any  
responsibility for damages resulting from following these  
instructions. You do so at your own risk. Remember, any  
tinkering with the computer completely voids your warranty and  
may be hazardous to the health of your computer and the frail  
threads of your patience and/or sanity.  
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To those of you who saw the movie "ROXANNE" and thought there  
was something familiar about the town of Nelson. That is the  
home of Fred Nachbaur, our very own TS-1000 guru.  
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The 23rd is the traditional date that the swallows LEAVE  
Capistrano. And with that little tidbit from FRANK'S ALMANAC OF  
FICTION AND FACT we also bid a fond farewell for now.

TILL NEXT MONTH Frank  
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# Plug J12

	1	2	3	4	5	6	7	8	9	10	11
1			F1	F2	F3	#4	#5	#7	F4	F5	
2			#2	Q	E	T	#6	U	#8	#0	
3			W	TAB	R	Y	I	O	#9	-	
4			#3	#1	A	D	H	J	L	P	
5			CAPS LOCK	S	F	G	K	;	[	=	
6			Z	C	B	M	.	"	]	£	
7				X	V	N		,		/	
8			←	ESC	→	SPACE	↑	↓	ENTER	\	
9	CTRL	SHIFT									ALT

Plug J11

Blank squares are not used.

NOTICE: The instructions which follow are to assist you in accomplishing the task. I will not be responsible for damages resulting from following these instructions. You undertake this on your own responsibility. Modifying the QL in this manner will void your warranty.

### SINCLAIR QL TO IBM PC/XT CASE CONVERSION

The Sinclair QL is a fine computer, but it is hampered somewhat by a membrane keyboard which tends to bind and a close-fitting case which causes heat problems. If any expansion is done, such as adding disk drives and a modem, the work area starts to get cluttered.

The solution to these problems is to insert the QL into a PC case. Removing the top of the QL case eliminates the overheating, since the heat has more air space to dissipate into. The PC case has ample room for disk drives, power supplies, modems and even microdrives. I chose the PC/XT case, which has cutouts for two full-height floppy drives. As I reconfigured it, one side is used for a full height quad density 5 1/4" floppy drive. The other side is taken up by the two microdrives and an external modem. It is not necessary to install both microdrives when a floppy drive is added. mdv1\_ is all that is needed (for booting). On the other hand, there is no reason NOT to install them either.

The keyboard has been replaced by a mechanical key (SPST) keyboard which permits you to add extra keys and reconfigure the key placement to suit yourself. The keyboard has its own enclosure, connected to the PC case by a ribbon cable. This allows greater flexibility in placing the units to best advantage.

You will need the following tools and supplies;

- a) Phillips head screwdriver
- b) Flat head screwdriver
- c) Wire cutters
- d) Soldering iron
- e) Solder
- f) Continuity checker (multi-meter, test lamp, etc)
- g) Hacksaw
- h) Wire
- i) Ribbon cable (25 conductor)
- j) 25 pin subminiature D connectors
- k) Printed circuit board with edge connectors
- l) Mechanical switch keyboard
- m) Keyboard enclosure (purchased or built)

Item f is a must; you have to be able to test your soldering at each step. You can't tell by looking.

The following items are optional and depend on the installation methods you use and the extra equipment you add;

- a) Silicone adhesive
- b) Power drill
- c) Tap and die set
- d) Dremel Moto-tool or the equivalent
- e) Power supply
- f) 32-pin edge connectors (male and female)
- g) 9 pin subminiature D connectors (male and female)
- h) 8 pin DIN connectors (male and female)

These instructions are written with the idea that you know very little about computers or electronics. It's better to give too much information in projects like this, since what you don't know can cause serious damage. I DO assume you can handle the simple soldering involved. If you can't, STOP RIGHT NOW!! There is no way you can do this job without soldering many, many connections correctly. I also assume you can use a meter or test lamp to check continuity in a wire. If you can't, find out how to do it. It's not hard but it is absolutely necessary for success in this

project.

First off, assemble the PC case if required. Mine needed a number of small parts fastened into it. Remove the front panel and disk drive mounting hardware to make room to work.

If you are adding disk drives, install a PC power supply at the right rear of the case. The case has predrilled holes for the purpose. Any unit that has enough power for the intended purpose is fine.

Now remove the QL top cover. There are screws in the bottom holding it on, some of which may be covered by warranty labels. (You DO know that this voids your warranty, don't you?) Remove the screws and save them. Carefully lift off the cover. It's still attached to the motherboard by wires and plastic strips. Unplug the drive and power indicator lights by pulling the plug out of its socket next to the microdrives. Unplug the keyboard by pulling the plastic strips out of their sockets. Make sure they come out and do not tear off in the sockets.

The top cover should now be free. Lay it aside for now. Remove the heat sink from the input power connection. It's held on by a screw in the center. Unplug the microdrive ribbon cables from their sockets. It takes a good pull, so be sure to hold the sockets down to avoid overstressing the connections. Pay close attention to what wires go where because you're going to have to put them back later. Make notes if necessary. Remove the microdrives. Screws in the bottom of the case and top of the microdrives hold them in. Remove and save the screws.

Now remove the motherboard from the case. It's held in by small screws from above. Remove and save them. The motherboard should lift out now. The various ports and expansion plugs come with it. Watch out for the reset button; you must press it in to clear the case. You now have the heart of the QL in your hands. Treat it tenderly.

Take the motherboard to the PC case. You need to decide where to mount it which depends on the case you selected. Remember that you must have room to plug the cables into the back and any expansion devices into the left side. You also have to be able to press the reset button. The only space big enough in my case is under the disk drives. Because the QL is so wide, it is impossible to plug expansion modules directly into the left side socket. Instead, an extension ribbon cable must be made to allow such devices to be relocated either above or behind the QL. Once your decision is finalised, mark the location on the case and put the motherboard in a safe place.

Go back to the QL case. This is the point of no return because you are about to take an irreversible step. Both the microdrives and the QL need the case bottom for attachment points. Since you are separating the components, it is necessary to cut the case apart. A hacksaw works well for this. Note the clear plastic sheet in the bottom of the case. Use it as a guide in cutting out the section of case which holds the microdrives in place. Do the same thing with the top of the case which is needed to hold the cartridges down, but first remove the wiring which is wrapped around one of the screw socket posts. You'll probably have to cut the wires to the power indicator light. It doesn't matter since it is not really needed. Reassemble the microdrive case unit by replacing the microdrives, inserting and tightening the mounting screws and inserting and tightening the cover attachment screws. You now have the microdrives in their own little case with the cables sticking out the back. The back and one end are open. We'll deal with that later.

If your PC case is too narrow to permit the expansion port to be used intact, you must cut off the left end of the QL case. Use the motherboard to find the location, leaving enough case to protect the socket. Hack the rest off. Now replace the motherboard in the remaining case bottom using the screws you saved earlier and attach the assembly to the PC case. I decided to glue it in place with silicone sealer. If you want to use screws or bolts to make removal easier you will have to attach the case before installing the motherboard. Don't let bolts or screws touch the motherboard; vibration could cause printed wires to wear through and short out.

Install the QL power supply in the PC case in a location which allows you to plug its lead into the QL and run the power cord out the back of the PC case. Protect the cord where it goes thru the case with a plastic or rubber grommet. Be



careful plugging into the QL, the power connector used the lid for support. You should add some extra support to compensate for the missing cover. Remember to leave room for the expansion module. You have to have one for the disk drive interface at least. If you are buying one, the Trump card is an excellent choice, since it includes both memory expansion and drive interface in one unit. Now set the unit aside and start on the keyboard assembly.

The new keyboard must have mechanical switches with two contacts. Avoid Hall effect or capacitance switches. They won't work. ASCII encoded keyboards are no good either unless you can decode them which is an extra expense. Keys which work by shorting out two points on a printed circuit board are no good either, because you can't change the wiring. You want simple mechanical switches, preferably without any pc (printed circuit) board at all. Select a keyboard with at least 65 keys; more are better because you can add extra features or use the extras for spares but less won't work.

I used a 74 key ASCII encoded keyboard with mechanical switches. I had to remove the pc board and it's no fun. The Dremel Moto-tool helps. If your keyboard has such a pc board it must be removed because it has wires connecting the switches together in ways you don't want. Cut the board into pieces, unsolder the connections and remove the pieces. It's possible to simply cut through all the printed wires but BEWARE! There are usually wires on both sides of such boards and you have to cut ALL of them.

The QL uses a keyboard matrix to decide which key has been pressed. This means that your keyboard must be wired the same way if you expect it to work correctly. However, the position of the keys doesn't matter at all. All that counts is that the keys are wired together correctly. Your first task is to decide on the physical layout of the keys. This will be influenced by the keyboard plate itself, which usually contains rectangular holes to hold the key switches in place. You can move the key caps or you can move the switches themselves to whatever positions suit you. The main letter keys are pretty standard (QWERTY etc.) but if you want a DVORAK, fine. I considered a layout to simplify things for one-fingered right-handed typists. Maybe later.... I moved the function keys to the right side and the arrow keys to a T shaped section on the right also. I put a CONTROL key below the ARROW keys in addition to the one on the left side. ALT is there too. Now I have one-handed editing with thumb on CONTROL and fingers on the ARROWS. Use your imagination. What else would make life easier for you? Duplicate keys are easy. Put an extra CONTROL key in, or a right-side TAB key, whatever helps. It's possible to have one key do several things, CTRL-SHIFT-F2 for example, but this involves battery powered relays and such, and I decided against it. Suit yourself on this, it depends on your electrical skills. The one thing you CAN'T do is add new kinds of keys because if they aren't in the QL keyboard matrix already, there's no way to add them.

Once your keyboard suits you, flip it over and label all the keys on the back side because that's where you'll be working from now on. Make two copies of your keyboard layout on paper as seen from the back side. Label one 'Plug J11' and the other 'Plug J12'. Now look at the QL matrix diagram. The rows are numbered from 1 to 9 and the columns are numbered from 1 to 11. These numbers refer to the wires in plugs J11 and J12 on the motherboard where the plastic strips were plugged in. The wires are numbered from left to right in each plug as seen with the QL in normal operating position. You must wire your keyboard exactly this way.

Take the paper copy marked J11. Draw a line connecting each key in row 1 to every other key in row 1. Find a way to do it with one continuous line...no Y or X connections if possible. Run the line off the top of the diagram and label it with the row number. The line represents the path to be taken by the wire you are going to install and you want to solder only one wire to each terminal if possible just to minimize your work. Repeat with all the other row numbers. Always connect to the same key switch terminal in each case. (The other one is for the column wires. Actually, it wouldn't matter if you mixed them but you'd have a hard time keeping track of things if you did.) Repeat the process on the second sheet, this time connecting all the keys in each of the columns, using the other key switch terminal.

You now have a custom wiring diagram for your keyboard layout. Heat up your soldering iron and go to it. I found that wirewrap wire works well. It's insulated and very flexible. Wrap it once or twice around the terminal and solder away. The

heat melts away the insulation, permitting a connection. Note that a wirewrap tool won't work because you don't have wirewrap posts on the keys. Follow your wiring diagram carefully. If you have added duplicate keys, just be sure the correct wires run to them as well as to the original key. As you finish each wire, run about 6 inches of extra wire to the top of the keyboard and either label it or solder it directly into a 25 pin D plug. Keep the J11 and J12 wires separated. I put the J12 wires in the top and the J11 wires in the bottom. It doesn't matter as long as you know WHERE they are. Test each wire with the continuity checker. Saves going back later when it doesn't work!!

Once all the wiring is done and tested, check it against the QL matrix. For example, the R key has wires J11/3 and J12/5 attached to it. Hook your tester to pins J11/3 and J12/5, press the R key and see if you have continuity. If not, correct your error. Repeat for the other keys. When you're finished you'll have what looks like a rat's nest of wiring on the back of the keyboard. Don't worry about it. It may not be pretty, but it WORKS. (Doesn't it?)

If you purchased a keyboard enclosure, make whatever changes may be needed to make it fit your keyboard. If you're building your own, naturally you will make it to fit. Plastic, aluminum, wood or even Masonite work quite well enough. Appearance is up to you. Be creative.

Now install the keyboard in its enclosure. The D plug attaches to the back panel. If the wires are not attached, do so and do the test described above, checking each key for correct hookup. Make an extension cable out of 25 conductor ribbon cable with a 25 pin D socket on each end. This can be as long as you wish. It depends on where you will be placing the socket on the PC case, front or back. Remember if you are using solderless sockets that there is more than one way to install them, but only one CORRECT way! Use your continuity checker to be sure.

You must make two cables to plug into sockets J11 and J12 on the motherboard. The QL had two strips of plastic stuck in there but you can't solder to them. You have to make new plugs to fit the sockets. Get a printed circuit board with 10 edge connectors per inch. Cut two strips out of the edge connector section, one with 9 conductors and one with 11 conductors. Use the Dremel to grind the back side of these strips away. You want to reduce the pc board material to a uniform thickness of about 1/32 inch. It has to be thin enough to fit into the socket but thick enough to take the strain. Cut and fit is indicated here.

Here's a point to consider. If you plan on placing the monitor on top of the PC case a front keyboard plug is easier to get at. On the other hand, if you plan on placing the monitor BELOW the PC, a back plug is better. I wish I had thought of this sooner! My desk places the monitor at steep downward angle behind the keyboard which makes it easier to read, especially if you have bifocals or reading glasses. The PC sits on a shelf above the monitor. Since I put the plug in front, the new ribbon cable dangles in front of the monitor which is not a good idea. A longer extension cable will cure the problem by running under the PC and down, but a back plug would have been better.

Back to work. Take a length of ribbon cable long enough to reach from the sockets to the front (or rear) wall of the PC case, wherever you want the keyboard to plug in. Strip off a 9 wire and 11 wire portion. Solder the ends to the edge connectors you just made up. The other ends are soldered to the pins of the 25 pin D plug EXACTLY like the plug on the keyboard is arranged. Ribbon cable wires are very fine so you may wish to connect adjacent pairs together to make heavier wires. (If so, remember to double the wire count!!) Attach the D plug to the PC case and plug the strips into J11 and J12.

Time for a first test. Plug the monitor into the QL socket, the keyboard extension cable into the plug on the PC case and the keyboard, the QL power lead into the QL and the power cable into the wall socket. You should see the opening screen (F1 ... Monitor etc). If not, well, win some, lose some!! Throw the whole mess in the trash, buy a new QL and start over. Or, if you don't care for that idea, start tracing backward. You've made an error somewhere. The QL will not work without the keyboard plugged in, so that's the first thing to check. Are the plugs in? Straight? Far enough? Unplug them and check each line for continuity. All OK? Still doesn't work? Check the extension cable the same way. Still no luck? Recheck the keyboard. If it's OK, you're in real trouble. You've managed to damage the

motherboard some way. Your only recourse now is to find a service center that can help you. Or order a QL kit for \$75, which would probably be cheaper than a service center. And this time, BE MORE CAREFUL!!

Assuming the first test was successful, test all the keys by typing them while the QL is on. Make sure each key writes correctly to the screen, both upper and lower case. You may find some that don't. If so, check the wiring for that key. Bad solder joints are the usual reason. Check for continuity across the key terminals with the key NOT pressed; the key may be shorted internally. Look for continuity at the cable plug, checking from the key terminal to the plug pin. If it is open you have a bad joint in that wire. Find and fix. If the wiring checks OK, try shorting between the terminals with a piece of wire. If the character prints on the screen, the key switch is bad. Try contact cleaner. If that fails, replace the switch. You probably have some extras if you got a 74 key keyboard.

If the memory test fails (that multicolor pattern when you first turn the QL on) and the screen locks up or turns green or some such, the problem is likely to be in the J11 and/or J12 plugs. Look for shorted wires or a plug in crooked enough to cross-connect the conductors. NEVER assume it's the QL; the machine is surprisingly tough.

When all keyboard problems have been fixed you are ready to install the microdrives. You probably need to make longer cables if you relocated the microdrives. Cut about an inch off each old cable, strip the ends of both pieces of all four cables, and splice in enough wire to make them as long as you need. Tape or otherwise insulate your splices to prevent shorts when the cables get bent into place.

Mount the drives wherever you decided to put them, remembering that you have to be able to get at the bottom of the case to remove the drives (so don't glue them down unless there are access holes). The open side of the case weakens it, so fasten a metal or plastic support from the PC case to the top of the microdrive case. If you wish to mount both microdrives in a floppy drive opening, you will have to cut away part of the PC case opening frame to get it to fit. The two microdrives are just a little bit too wide.

Plug the cables into the proper sockets. This can be difficult, since you have seven small wires to get into seven small holes all at once. You have to force them in without bending any of them under. Tinning them can help stiffen them, but don't get them thicker or they won't fit the holes. Not much to go wrong here unless you plug them in backwards or something. Plug the microdrive lights back into the motherboard. (Splice in extra wire if necessary.) The lights can be relocated if you wish, or you can replace them with LEDs (Light Emitting Diodes). This also applies to the QL 'Power On' light. Replace the heat sink which attaches to the input power connection.

The rest depends on the extra equipment you're adding. Make an extension cable for the disk interface or whatever you are plugging into the left expansion port. You could run it outside the PC case, but that would defeat the purpose in doing all this in the first place! Mount and plug in any extra drives or disks. Serial ports and joystick ports can be extended to the PC case wall or not as you wish. Frequency of use may be the deciding factor here. Those plugs aren't cheap. If you don't use them too often, just open the PC case lid, plug in to the QL and go. (The same principle applies to the ROM port as well.) The monitor plug should probably be one to move. Don't bother trying to move the existing plug; use an extension cable to plug into the QL and attach to the PC case in back.

Your computer is back in operation now but you do have one problem. Some of the keys are mislabeled, especially the upper-case characters. I don't have a good solution for this. You can make stick-on labels like I did or try repainting them.

One last item. The reset button needs to be reachable, but it isn't easily removed from the QL. I drilled a hole in the PC case and ran a rod from the switch out the hole. A tube inside the case supports it. The rod is bigger in diameter inside the case than outside, so it can't fall out.

Time for the final test. Plug in QL power and PC power, turn on PC power switch and GO!! If not, tough luck. Start rechecking, working backward.

COMMERCIAL MESSAGE

If you feel confident in your abilities and want to try it on your own, assemble the various components and have at it. There are any number of mail-order houses which can supply keyboards and such. I got my case and keyboard from Jameco. Radio Shack is good for some items, although they don't stock the 8-pin DIN plugs for the monitor.

If you would like to save some time and effort, the keyboard I used is available in a kit which includes the keyboard, wirewrap wire and the two keyboard motherboard plugs. (You supply the ribbon cable and plugs because I don't know what you'll need.) The price of the kit is \$19.95 postpaid. You already have the instructions.

If you feel that the job is beyond you, don't despair. You can order your own customised keyboard with new motherboard plugs attached for only \$129.95 postpaid.

The keyboard enclosure is not included because they're unreasonably priced. You're better off making your own. If money is no object, add \$59.95 for a keyboard enclosure custom fitted to your key layout.

If you want the whole thing done for you, send me your QL, the keyboard diagram, any extra equipment (such as disc drives or modems) and a check for \$349.95. If I can't fit it all into the case we'll discuss your options.

If you don't want to use your own QL, a QL kit costs an extra \$75. This is the QL in pieces, not a bad way to go from MY position. Saves on disassembly work. No software or manuals with the kit.

You don't have a QL? Add an extra \$199.95 for a new one, which includes software and manuals.

The time required will depend on the amount of work you want me to do for you. Allow a week for a bare keyboard, two weeks for keyboard and enclosure, a month or more for the whole conversion.

A word of caution; since this is custom work, no refunds are possible. I guarantee that the equipment I supply will work as described. Defects in the equipment you provide (if any) are your problem. If you send any equipment with your order, be sure to insure it. I don't fix broken hardware unless I break it.

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